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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,086	01/09/2006	Frederick Marcel Van Der Vliet	GEML 4793-3 US	4507
54413	7590	11/03/2006		EXAMINER
		GEMFIRE c/o HAYNES BEFFEL & WOLFELD LLP		ANDERSON, GUY G
		P.O. BOX 366	ART UNIT	PAPER NUMBER
		HALF MOON BAY, CA 94019		2883

DATE MAILED: 11/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

EX

Office Action Summary	Application No.	Applicant(s)	
	10/521,086	VAN DER VLIET, FREDERICK MARCEL	
	Examiner	Art Unit	
	Guy G. Anderson	2883	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 04 October 2006.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-9, 13 and 14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-9, 13 and 14 is/are rejected.
- 7) Claim(s) 5 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 04 October 2006 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>1/9/2006 & 10/9/2006</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Response to Arguments

- 1.1 Regarding the objection to the drawings for the omission of a reference figure, applicants have corrected the deficiency and the objection is withdrawn.
- 1.2 Regarding the objections to the disclosure:
 - a) indicating a splitter in Fig. 2 instead of Fig. 3, applicants have corrected the deficiency and the objection is withdrawn.
 - b) using reference indicator “element 31” to describe more than one element, applicants have corrected the deficiency and the objection is withdrawn.
 - c) referring to a PLC as either element 18 or 40, applicants has clarified their use of PLC #18 and PLC#40 and the objection is withdrawn.
- 1.3 Regarding the objection to the use of the term ‘substantially’ in Claim 5, applicant states in his Arguments/Remarks on page 10 that the term ‘substantially’ has been deleted from the claim. However, the amended claims submitted with the Arguments/Remarks dated October 4, 2006 do not indicate that the term ‘substantially’ has been deleted. Therefore, examiner cannot withdraw his objection.
- 1.4 Regarding the rejections of Claims 1-8 under 35 U.S.C 103(a) in view of Bouda in combination with Laurent-Lund, applicant argues that Bouda teaches a non adiabatic tapered waveguide portion that does not merge continuously with the input waveguide, but instead has an abrupt transition from the input waveguide to the tapered waveguide. Further, he argues that Bouda does this because he wants to generate higher order modes. Applicant goes on to argue that Laurent-Lund teaches a continuous merge but that it is adiabatic because he does not want to generate higher order modes. Applicant concludes that because one reference teaches generating higher order modes and the other reference teaches not generating higher order modes, that they are not combinable and that they in fact teach away from each other.
- 1.5 Examiner respectfully disagrees for the following reasons. Firstly, there is absolutely no mention in Claim 1 of generating modes or not generating modes. The structure set forth in claim 1 is a power splitter with at least two outputs and tapered waveguide portion between the inputs and outputs.

1.6 Secondly, Bouda discloses a structure that in every way anticipates the structure of Claim 1 with the exception of the tapered waveguide merging substantially continuously with the input waveguide. Laurent-Lund discloses the limitation of a tapered waveguide merging continuously with the input waveguide. Both Bouda and Laurent-Lund disclose devices the purpose of which is to split an input lightwave into multiple output lightwaves with equal power or intensity profiles. Bouda discloses that he uses the abrupt transition to ensure only that a discrete number of optical modes are supported. This number will depend upon how many outputs the splitter is being designed for, as Bouda's preferred embodiment is a splitter with more than two outputs. Thus it is necessary to couple lower order modes into higher order modes but in manner that is controllable so as to minimize losses.

[Bouda at Abstract, Col. 4, Lines 52-67, Col. 5, Lines 1-67, Col. 7, Lines 1-5.]

1.7 Laurent-Lund is also disclosing a device wherein he anticipates a certain number of modes to be supported in the tapered waveguide portion. His reasoning for using the substantially continuous merge is because his preferred embodiment is a two output Y branch splitter and he wants to minimize the number of higher order of modes that are excited in the transition from the input to the slab waveguide portion. His device relies on at least one higher order mode being supported in the tapered portion in order to have two outputs, but he also is trying to control the number of higher order modes being excited in the tapered waveguide portion. [Paragraph 59, 79, 80, 81, 83.]

1.8 Examiner contends that one of ordinary skill in the art, looking at Bouda and Laurent-Lund, would have realized that Bouda could be modified by Laurent-Lund into a Y-Branch splitter with a non-adiabatic tapered waveguide wherein the tapered portion merged substantially continuously with the input portion.

1.9 Examiner maintains his rejections.

Response to Amendment

2.1 The amendment filed October 4, 2006 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: The applicant amended a formula in the on page 5 and did not clearly state the reasons for the change. Examiner contends that

without explanation, the change in the formula could significantly impact the design of the stated invention.

2.2 Applicant is required to cancel the new matter in the reply to this Office Action.

Objections

3.1 **Claim 5** is objected to because of the use of the term “substantially.” Substantially is an ambiguous term and fails to define or limit the following term “symmetrical.”

Claim Rejections - 35 USC § 102

4.1 The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4.2 **Claims 1, 13-14** are rejected under 35 U.S.C. 102(e) as being anticipated by US-6768842 to Bulthuis et al.

Bulthuis specifically discloses an arrayed waveguide grating comprising/wherein:

- 1) a splitter comprising a substantially single-mode input waveguide, at least two output waveguides; and a non-adiabatic tapered waveguide optically coupled between the input waveguide and the output waveguides, said waveguides being formed on a substrate, wherein the non-adiabatic tapered waveguide, along at least a portion of its length, widens in width towards the output waveguides, in a plane parallel to the substrate, and the non-adiabatic tapered waveguide merges substantially continuously with the input waveguide in a direction parallel to the optical axis of the input waveguide.
- 13) the non-adiabatic tapered waveguide has a shape in a plane parallel to the substrate that excites a second order mode therein but substantially no mode higher than the second order mode.

14) the non-adiabatic tapered waveguide has a shape that forms a double-peaked field at the junction between the tapered waveguide and the output waveguides.

[Bulthuis at Fig. 9, Col. 2, Lines 9-45, Col. 9, Lines 1-35.]

Claim Rejections Under 35 U.S.C. 103(a)

- 5.1 The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.*
- 5.2 **Claims 1-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouda in US-6643432 in combination with Laurent-Lund in US-2005/0207705.
- 5.3 **Regarding Claim 1**, Bouda specifically discloses a splitter comprising:
- 1a) a substantially single-mode input waveguide (Fig.1, Col. 4, Lines 30-50);
 - 1b) at least two Output waveguides (Fig.1, Col. 4, Lines 30-50);
 - 1c) a non-adiabatic tapered waveguide optically coupled between the input waveguide and the output waveguides (Fig.1, Col. 4, Lines 30-50);
 - 1d) said waveguides being formed on a substrate (Fig. 5);
 - 1e) wherein the non-adiabatic tapered waveguide, along at least a portion of its length; widens in width towards the output waveguides, in a plane parallel to the substrate (Fig.1, Col. 4, Lines 30-50 and Fig.5).

Bouda does not specifically disclose a splitter wherein:

- 1f) the non-adiabatic tapered waveguide merges substantially continuously with the input waveguide in a direction parallel to the optical axis of the input waveguide.

However, this limitation is taught by Laurent-Lund (Fig.10 and Paragraph 81). Therefore, it would have been obvious to one who was skilled in the art at the time of invention to combine the non-adiabatic tapered waveguide of Bouda with the

- non-linear waveguide of Laurent-Lund in order to provide a homogenous distribution of power between the output waveguides (Laurent-Lund at Paragraph 81).
- 5.4 **Regarding Claim 2**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claim upon which Claim 2 depends. Bouda does not specifically disclose a splitter wherein:
- 2) at least an initial portion of the non adiabatic tapered waveguide proximal to the input waveguide has a taper angle which increases towards the output waveguides.
- However, this limitation is taught by Laurent-Lund (Fig.10 and Paragraph 81). Therefore, it would have been obvious to one who was skilled in the art at the time of invention to combine the non-adiabatic tapered waveguide of Bouda with the non-linear waveguide of Laurent-Lund in order to provide a homogenous distribution of power between the output waveguides (Laurent-Lund at Paragraph 81).
- 5.5 **Regarding Claim 3**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Bouda specifically discloses a splitter wherein:
- 3) the non adiabatic waveguide tapers gradually so as to excite a second order mode therein (Col. 4, Lines 44-50).
- 5.6 **Regarding Claim 4**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Bouda does not specifically disclose a splitter wherein:
- 4) the length of the non-adiabatic tapered waveguide, in a direction parallel to the direction of propagation of an optical signal therein, is such that the phase difference between the fundamental and second order modes, at an output end of the non-adiabatic tapered waveguide is equal to $M\pi$ where $M=1,3,5,\dots$
- However, it is well known in the art that by changing the length of the waveguide, a designer may introduce a π phase difference at the output between fundamental and higher order modes denoted by $M= 0, 1, 2, 3\dots$ (For related art see Bae, US-

- 6728438). Therefore, it would have been obvious to one who was skilled in the art at the time of invention to design the length of the waveguide such that a phase difference between the fundamental and second order modes was achieved so as to provide for an homogenous distribution of power at the output (See Laurent-Lund at Paragraph 81).
- 5.7 **Regarding Claim 5**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Both Bouda and Laurent-Lund specifically disclose a splitter wherein:
- 5) the non adiabatic tapered waveguide tapers substantially symmetrically with respect to the direction of propagation of an optical signal therein (See Bouda Fig. 1 and Laurent-Lund Fig. 10).
- 5.8 **Regarding Claim 6**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Bouda specifically discloses a splitter wherein:
- 6) the non adiabatic tapered waveguide has opposing tapered sides each having a taper shape (Fig. 1) (based on a perturbed cosine function).
- The examiner gives no patentable weight to the highlighted limitation “perturbed cosine function” as it is a function and not a product limitation.
- 5.9 **Regarding Claim 7**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Bouda does not specifically disclose a splitter wherein:
- 7) said output waveguides are substantially single mode.
- The examiner gives no patentable weight to the term ‘substantially single mode’ because applicants own definition of ‘substantially single mode’ in the disclosure allows for the waveguides to be multi mode as long as no significant signal is effectively carried by the higher order modes. Additionally, single mode output waveguides are well known in the art. (See Ido in US-6236784, where the output waveguides have the same physical width as the single mode input waveguide in Fig. 1 and 2).

5.10 **Regarding Claim 8**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 2 depends. Bouda does not specifically disclose a splitter wherein:

8) at least one of the output waveguides has an adiabatically tapered end which is connected to an output end of the non-adiabatic tapered waveguide and which widens in width towards the non-adiabatic tapered waveguide.

However, Bouda specifically discloses prior art star couplers where tapers are provided at each of the output waveguides (Col. 2, lines 27-36). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to provide the invention of Bouda with tapered output waveguides in order to obtain uniformity in the optical coupling at the output ports (Col. 2, Lines 27-36). For related art see McGreer in US-2002/0159703.

5.11 **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bouda in US-6643432 in combination with Laurent-Lund in US-2005/0207705 and in further view of Li in US-5745619.

5.12 **Regarding Claim 9**, the combination of Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 9 depends. However, the combination of Bouda and Laurent-Lund does not disclose a splitter comprising:

9) wherein there is a gap between an output end of the non adiabatic tapered waveguide and respective ends of the output waveguides optically coupled thereto.

However, Li specifically discloses an embodiment whereby a transverse gap isolates the output waveguides (Fig. 6E, Col. 7, Lines 25-40). Therefore, it would have been obvious to one who was skilled in the art at the time of invention to provide the combination of Bouda and Laurent-Lund with a transverse gap between the tapered waveguide and output waveguides in order allow for the signals to act more predictably given the practical manufacturing tolerances in the current environment (Li at Col. 7, Lines 25-40).

Conclusion

6.1 The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Art Unit: 2883

Patent Number/Identifier	Name	Relevancy
US-20020159703	McGreer	Non Linear Tapered waveguides
US-6236784	Ido	Y branching waveguide
US-6222966	Khan	Adiabatic waveguide with chirp control
US-6553164	Ono	Y branch waveguide
US-6728438	Bae	Control of mode conversion
US-6633703	Katayama	Tapered waveguides

6.2 Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

6.3 A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6.4 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guy G. Anderson whose telephone number is 571.272.8045. The examiner can normally be reached on M-Th 1130-2200.

6.5 If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on 571.272.2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

6.6 Date and signature of assistant examiner.



October 22, 2006



Frank G. Font
Supervisory Patent Examiner
Technology Center 2800